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The RACE Program in 1988

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The program called Research and Development in Advanced Technologies for Europe (RACE) was first planned in 1985. This report details the projects approved for the 5-year period beginning in 1988. The goal of the RACE program is to contribute to Europe-wide Integrated Broadband Communication.

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Contents

THE RACE PROGRAM IN 1988

Introduction

Early plans for the program called Research and Development in Advanced Communications-Technologies for Europe (RACE) were reported in ESN 39-3:122-123 (1985), and a comprehensive description of the work of the definition phases carried out in 1986 was given in ONRL Report 8-014-R (August 1988).

Approval for the 5-year research program was given by the Council of Member States on 14 December 1987 and the program, with an approved budget of 550 million ECU ($633 million) began in early 1988.

The goal of the RACE program is to make a major contribution to the introduction of Integrated Broadband Communication (IBC) taking into account the evolving Integrated Services Digital Network (ISDN) and national introduction strategies, progressing to community-wide services by 1995.

In view of the above goal the general objectives of RACE are to:

- Promote the Community's telecommunications industry so as to ensure that it maintains a strong position at European and world levels in a context of rapid technological change
- Enable the European network operators to confront under the best possible conditions the technological and service challenges with which they will be faced
- Enable a critical minimum number of Member States of the Community to introduce commercially viable IBC services by 1996
- Offer opportunities to service providers to improve cost performance and introduce new or enhanced information services which will earn revenue and give support to other productive sectors of the Community
- Make available to the final users, at a cost and on a timescale at least as favorable as other Western countries, the services which will sustain the competitiveness of the European economy over the next decades and contribute to maintaining and creating employment in the community
- Accompany the formation of a Community internal market for all IBC-related telecommunications equipment and services based on agreed European or international standards as an indispensable basis for sustained strength on the world market
- Contribute to regional development within the Community with the support of the development of common functional specifications for equipment and services permitting the less developed regions to benefit fully from the efforts of Member States piloting the telecommunications development in the Community.

To achieve its objectives the RACE program is structured into the following parts:

I. IBC development and implementation strategies relating to the development of functional specifications, the systems and operations research towards the definition of proposals for IBC standards, concepts, and conventions conforming to an open systems approach, and the analytical work serving the objective of establishing interoperability for IBC equipment and services;

II. IBC technologies covering the technological cooperation in precompetitive R & D addressing key requirements of new technology for the low-cost realization of IBC equipment and services;

III. Prenormative functional integration relating to cooperation in the realization of an open verification environment designed to assess functions, operational concepts, and experimental equipment and applications with respect to functional specifications and standardization proposals arising from the work in the part I.

RACE Projects

Following are the RACE projects, listed by project number and name.

1001. Digital Video-Tape-Recording Terminal for HSTV. Project 1001 addresses the development of an advanced cost-effective digital tape recording technology for high definition television (HDTV) whereby also the recording of standard TV is included. Concentration will be on the development of a digital recording system providing high recording densities and bit rates up to 100 Mb/s, requiring a channel capacity 10 times higher than that in analog consumer video recorders. Bit-rate reduction techniques for magnetic tape recording will be used to reduce the HDTV recording bit-rate from about 1000 Mb/s to 100 Mb/s or lower. Because of requirements on multispeed operation of the recorder and because recording channel error characteristics are very different from transmission error characteristics, requirements on bit-rate reduction techniques are quite different from the requirements or these techniques for transmission.

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Therefore, the work on bit-rate reduction for magnetic recording must be done separately from the consortium's addressing of video coding for transmission. This project is primarily addressing a task of Part II of the RACE main work plan. However, a demonstrator will be realized which can be connected to an experimental IBC network in the last phase of the project. Furthermore, for network/recorder terminal interfacing and coding consistency, use will be made of related results from Part I of the work plan.

1002. Satellite Communications for Integrated Broadband Communication Network (IBCN). The objective of this project is to clarify and to optimize from a service viewpoint the role of satellite communications in a pan-European IBCN. The study will begin with two general analyses:

- Identification of the service which can be efficiently provided by satellite systems, and quantification (from a user point of view) of the advantages of the satellite approach. This analysis will also cover security and problems.
- Survey of the existing satellite systems characteristics and planning for the systems which cover Europe (EUTELSAT, Telecom 1, ITALSAT...) or interface with European terrestrial network (INTELSAT, INMARSAT...). The survey will also consider the regulatory framework.
- During the second part of the study the functions of the part of the RACE IBCN potentially carried by satellite systems will be specified in order to assess the impact of satellite on RACE. To serve as input to the evolution plan which materializes the IBCN introduction strategy, different reference configurations incorporating satellites will be proposed and the detailed specifications of an optimized dedicated satellite system given.

1003. Guideline: Advanced Information Processing (AIP) and Standards for the Telecommunications Management Network (TMN). Project Guideline is intended to pave the way for the implementation of the TMN for the IBCN and the services that the network will carry. AIP processing techniques will be necessary to provide the functions required and to obtain the necessary performance.

It will be necessary to define an architecture for TMN together with a specification of the TMN system interfaces. This investigation of the architecture will also provide a framework for the coordination of the work of the consortia conducting the TMN technology projects.

Project Guideline will act as the focal point for the complex interacting between the TMN technology projects. It also provides a common interface to the other RACE consortia and international bodies. These link functions will operate through meetings, workshops, and mechanisms for the formal exchange of information between the various consortia. A significant responsibility of Guideline will be to establish a common electronic database for the consortia undertaking the TMN technology projects.

1004. Electroluminescent (EL) Flat Panel Display for Terminal Application. An EL flat panel display meeting the requirements to be created in the RACE program will be developed. A MINITEL terminal with a low-cost EL display of size A5 and with high brightness, brightness control, and grey shades is the first objective. Furthermore, a MINITEL terminal with an EL display of size A4 will be developed. This objective is to introduce through additional colors, red, blue, and green, on one display. High-voltage EL drivers will be developed for monochrome, grey scale, and color display. Studies of integration of EL displays into multiservice terminals will be carried out. Thin-film transistor technology will be studied in order to consider active matrix driving schemes and TFT driver integration into a future EL display. Demonstrations of prototype EL display with TFT's will be shown.

1005. Traffic and Quality of Service Management for IBCN (NEMESIS). The approach taken by project NEMESIS is to divide the available time into a number of experimental cycles, each of about 1 calendar year, and within each to build a small number of prototypes, each designed to test one as two aspects of the application of chosen AIP techniques to a single NMS function. Thus, early and continuous feedback will be available to guide further work within this project, to report to the commission and to provide assistance to other related RACE tasks, and to interact with other activities such as ESPRIT.

Each experiment will be conducted by a small group led by one partner. In parallel with the experiments an infrastructure will be developed which will evolve during the project into a permanent testbed for the experimental modules. The testbed and experiments will be designed according to an NMS architecture document, and this will be a first priority of the project.

The architecture work will continue, at a low level, during the life of the project to ensure that NEMESYS stays in line with RACE thinking. Another continuous supporting activity will ensure the availability to the experimental teams of technical support of the highest caliber in the key AIP areas.

Despite its small size, with only eight partners, the consortium represents all the key areas of industry and research and can address telecommunications and IT issues equally well.

1006. AIM:AIP Application to IBCN Maintenance. The objective of this project is to support the functional specifications of and standards for IBCN maintenance by developing appropriate IBCN technology. Guidelines and evaluation criteria will be developed for use in IBCN

maintenance, also taking account of the particular MMI requirements for maintenance.

The first track of the technical approach will evaluate existing digital network maintenance and enhance and generalize these capabilities for IBCN requirements. The second track will develop generic AIP maintenance systems and techniques. These techniques will be evaluated early on existing network applications and later on projections to IBCN requirements. The third track will be directly involved with the emerging IBCN specifications and reference model and will contribute to the definition of IBCN maintenance specification and standards. Key issues addressed are:

- Completeness and consistency of large distributed DBS/KBS
- Real-time maintenance capabilities
- Man/machine interface for providing appropriate operator support
- Uniform knowledge representation across TMA
- Integration of distributed maintenance subsystems
- AIP standards for maintenance.

1007. IBC Terminal for Interactive Services. The objective is to develop an interactive multiservices IBC-terminal demonstrator with a digital network-channel controller, an integrated digital video signal and sound processor, alphagraphic processor, and a display post processor, interconnected via an appropriate internal bus. The terminal is to be usable for mass and individual communications such as voice, video conferences, and text communications in several languages. The terminal will include a number of example services demonstrating multiservice capability. Activities relating to the development of the man/machine interface (MMI) for the terminal will include the definition of MMI prototyping environment and the prototyping of a multiservice man/machine interface for the IBIS terminal.

1008. Silicon-Based Low-Cost Passive Optical Components. This project is to demonstrate that silica-on-silicon integrated optics can be a solution to the RACE requirement for low-cost optical components. Considerable effort is being directed worldwide toward developing integrated optoelectronics based on GaAs and InP. However, no such solution has been proposed for passive devices. Fiber-based components are well suited to simple functions, but for more complex applications, fiber components will become both difficult to manufacture and expensive.

The project will address three aspects. First, the current status of the waveguide fabrication process will be further developed to provide a high-yield, low-cost process capable of providing high- quality waveguides. A key feature of using a silicon substrate is that grooves for holding input and output fibers can be defined as part of the waveguide fabrication process, making device assembly inexpensive. There, fiber-to-waveguide coupling will receive considerable attention during the project.

Second, a number of key devices will be developed. A 1:16 optical power divider, a 16-channel wavelength multiplex/demultiplex, and a polarization diversity receiver has coherent systems will be demonstrated and evaluated. The hybrid attachment of a laser to the silicon substrate and optical coupling to a silica waveguide will be demonstrated, with the aim of providing low-cost complex optoelectronic modules. These components are likely to be required at a future IBCN.

Third, studies will be undertaken to ascertain the cost of these components in volume manufacture and to determine the trade-off between component performance and cost. Component performance specifications will be derived from known system applications.

Major reviews of the project will be done at regular intervals.

1009. ADVANCE: Network and Customer Administration Systems for IBCN. The development of new network and customer administration systems will be based on thorough studies of the requirements of system users, technical constraints, the applicability of AIP techniques, a set of common functions, and the results of prototype implementations.

The possible application of AIP techniques to the provision of systems which fulfill the needs of the users will be investigated and evaluated based on the assessment of the operational characteristics of prototype systems implementing options for the provision of user function. Several successive versions of the prototypes will be needed in order to take account of functional specifications from RACE Part I projects, focused TMN, and of early results from ADVANCE. The integration of techniques and functions will present major problems unless it is based on a defined set of functions and utilities which will be commonly available to all network management systems and which serve as the interface to manufacturer-specific equipment. This stable interface will allow the development of totally new applications which call the new standardized functions as leading edge technologies mature in future years.

1010. Subscriber Coherent Multichannel (CMC) System. Preliminary studies in advanced subscriber systems employing multichannel coherent transmission were carried out in the RACE Definition Phase (RDP) 1032 project and supporting experiments have been performed in all key areas of the system. The results are encouraging and justify a RACE Main Phase (RMP) project, based on the conclusions of the RDP but with more emphasis on the realization of components, subsystems, and full systems. Also, essential work on dedicated devices and OEIC is required.

Evidence of the technical feasibility of the system concept will be provided by means of a system integration

experiment to demonstrate technical solutions and standards of component engineering and performance which will raise the status of CMC systems from laboratory experiments to practical and realizable options for the IBC network. In parallel, research in more advanced system techniques and dedicated component technology will be carried out to open the way toward technoeconomic feasibility of the CMC system within the IBC. A direct direction link will be included in the setup of the system integration experiment to show that an evolutionary change from earlier scenarios to the advanced scenario is possible.

During the RMP, experimental work up to a level of engineered prototype will be conducted in all the key parts of the system including multichannel coherent transmission, optical frequency tuning over a wide range, heterodyne receiver, special passive components, transmitter, and local tunable lasers.

The way toward more economic systems will be pursued by conducting research in more advanced systems, receivers, lasers, planar passive components, planar isolators, dual detectors for the balanced receiver inputs, and dedicated OEIC's for the polarization diversity configuration of the CMC receivers.

1011. Business Customer Premises Network (CPN). The CPN is the only part of the IBCN to which the end customer has direct access and which he may own. Therefore it is important to achieve a good cost/performance trade-off for the CPN. During the RDP, special attention was paid to domestic applications which were considered more critical for the IBCN. However, a market of broadband services in the business environment can become a reality in a few years, with risks of independent implementations of products which could lead to difficult interconnections in the future IBCN. Furthermore, the CPN requirements for business applications are somewhat different from the residential ones, thus fully justifying a study in the specific area.

The project will:

- Define the business CPN requirements and then establish an architecture which can act as a framework for satisfying these requirements across a range of applications and sizes
- Ensure that proper technologies are available to achieve the required cost and performance
- Implement subsystems of the overall predefined CPN architecture to validate technologies and system choices
- Integrate subsystems into a laboratory prototype to validate the feasibility of the model.

1012. Broadband Local Network Technology. The project will define a switch architecture which satisfies the requirements for a broadband multiservice switch operating in a network environment which can evolve towards ATM. A switch model will be designed which will use ATM as a switching mechanism. VLSI necessary for the construction of the switch model will be designed and fabricated and an experimental switch model will be constructed and evaluated.

The project will also produce a series of customer access connection prototypes based on optoelectronic integrated circuits and VLSI developed by the project with the target being a two-chip OEIC for the transmitter, receiver, and wavelength duplexor. A discrete component assembly, hybrid assembly, and a three-chip optoelectronic hybrid assembly will be fabricated and evaluated. A multiplexing technique will be chosen which conforms as far as possible with available multiplexing standards. VLSI will be constructed to support this multiplexing structure and to form a common interface with the switch.

1013. HDTV Switching. Switching networks for high-speed signals with up to 1 Gbit/s will be needed for HDTV. Switching and transmission of 1-Gbit/s signals within an extended switching network lead to problems of semiconductor technology, power consumption, equipment practice, and interconnection problems which are still not solved in an economic way. These problems will be investigated for VLSI and packing technologies and proven by demonstration.

1014. ATMOSPHERIC. Since synchronous transfer mode (STM) and asynchronous transfer mode (ATM) technologies need to coexist in broadband service this project will plan the introduction of both into a hybrid environment. The project will investigate hybrid structures in an attempt to assess the viability of such structures to meet transient needs for interworking with existing or planned networks during the transition phase.

The project will identify basic building blocks in functional groups relevant to switching and multiplexing of information in order to explore the technical feasibility of different system options in a hybrid environment. Examples of IBCN functional groups which include switching/multiplexing are Customer Premises Networks, Customer Access, Remote Switching Unit, Network Node Switch, and Internetwork Connections.

The final phase of the project will be to implement some of the key components to build up network elements in a hardware demonstrator in order to validate the desired concepts and technological performance of such characteristics as dimensions, speed, traffic, cost, power dissipation/consumption, and maintenance. The implementation will consist of both physical and software models. The project will contribute to the definition of validation strategy.

1015. Domestic Customer Premises Network. The main intention of this project is to prepare solutions to the design of domestic Customer Premises Network systems that will be manufactured in the future. The work plan contains work packages for the study, practical modeling,

and cost against performance evaluation for example solutions of a complete home network installation.

1016. Test Tools and Equipment. This project will produce new test strategies, methods, and procedures and develop prototype test equipment for the future IBC systems for the whole system life cycle. A test bed will be designed for the future IBC including the maintenance hardware environment bearing in mind that modern communication systems include hardware and software components that are incorporated in the IBC in an inseparable manner.

The three targets are the testbed itself, the software testbed, and the accompanying tasks supporting the work of the testbeds.

1017. IBC On-Line Environment. This project will specify methods, tools, techniques, and strategies for efficient implementation of IBC application software on dedicated hardware and on top of a telecommunications specific real-time operating system.

A real-time operating system will be defined for the IBC system providing support for on-line function extension, fault tolerant and test access by means of implemented primitives as well as the management of a real-time database and will allow connections to general purpose operating systems. The second task will deliver concepts on processor architectures mainly to directly support the on-line software environment. Fault detection and recovery, multiprocessor communication, and hardware extensions on the running network will be supported. A prototype on a transputer board will be delivered. The third task will be to specify the IBC environment for on-line function extension.

1018. High Quality Videotelephone and High Definition Television Systems. This project will prepare a harmonized and compatible family of systems for high-quality videotelephony and HDTV including the necessary network and standardization aspects. Advanced coding schemes for video signals for application of video telephones, standard definition TV, and HDTV will be addressed.

1019. Polymeric Optical Switching. This project is an exploratory program on the development of optically nonlinear polymers and their application in optical switching. It will cover materials, basic functional elements, and coupling.

1020. All-Optical Switching and Bistable Devices Based Semiconductor Polymers. The design and prototype construction of ultra-high-speed, low-cost, and low-dimension switching, memory, and amplifying devices using semiconducting organic polymers will be addressed. The primary objective is to demonstrate the feasibility of an ultrafast switch based on transient holography and a bistable device/transphasor using this technology. Prototypes of both devices will be built and tested.

1021. ARISE – A Reusability Infrastructure for Software Engineering. Two themes dominate this project: the development of the programing infrastructure and concern for the industrial assimilation of it. The development of the programing infrastructure will be based on a set of life-cycle models which express the concepts of the reuse and modularity of IBC software and the objectives, responsibilities, relationships, and capabilities of those concerned with the definition, implementation, certification, deployment, and lifetime management of telecommunications software.

1022. Technology for Asynchronous Time Division (ATD). Project 1022 will study ATD-related technologies, including hybrid aspects as far as necessary and develop generic components to be used in all related network subsystems.

1023. BEST – A Methodological Approach to IBC System Requirements on Specification. The BEST project will provide a service to the RACE Main Program Part I consortia by defining methods and specifying tools for requirements captured and functional specifications. It aims to complement and reinforce Part II activities, particulary in the software infrastructure tasks and the coordination of systemswide issues such as security and privacy, and unbundling.

1024. NETMAN – Functional Specification for IBC Telecommunications Management Networks. This project will produce a set of stable and concise functional specifications for the telecommunications management networks, and will submit these specifications to the international standards bodies.

1025. Functional Specifications of Security and Privacy in IBC. The objective of the RACE main work on security is to develop a functional and technological base to the realization and cost-effective implementation of such services. The project will identify the services required, for both security and security management, the inclusion of such services into other IBC functionality and the definition, specification, and interfacing of the primitives necessary to the implementation of the identified services.

1026. International Transmission of Digital TV and Radio. The project will study an evolutionary approach for the introduction of international digital television exchange at the European level taking into account the existing infrastructure (terrestrial lines and satellites), to minimize the number of A/D conversions. New measurement methods should also be introduced in order to evaluate the quality of the signal transmission. Coding of the signal itself will be carefully chosen to provide a quality virtually equivalent to studio quality but also allow easy conversion to general public digital broadcast TV standard.

1027. Integrated Optoelectronics Toward the Coherent Multichannel IBCN. This project will develop advanced integrated optoelectronic devices in indium-phosphide-based materials for the IBC network. The project structure is aimed to coordinate device development with the needs of the evolving IBCN, and to enable the project to define and develop the most economical technical solutions for the network hardware.

Initially in the IBCN two separate optical frequencies will be used for bidirectional transmission, in both trunk links and for customer access. As demand for bandwidth increases, optical frequency multiplexing (OFM) will be used to provide higher capacity overlay connections. OFM systems will also be used for broadband distribution and channel switching by wavelength selection, first using high-density wavelength division, multiplexing, and then fully coherent multichannel (CMC) techniques.

1028. Regional Evolution Planning for IBC (RESOLVE). This program will promote the introduction of IBC throughout Europe by 1995. RESOLVE will collect the information necessary to identify the key issues relevant to the harmonized and planned evolution of telecommunications network in the less favored regions. Analysis will be made of the requirements and constraints affecting these rural areas in the context of the evolution plans for the IBC in Europe. This information will be analyzed and will form an integral part of the development of the reference configurations for rural areas of Europe.

1029. Development of Improved InP Substrate Material for Optoelectronic Device Production. This project will develop improved InP substrate manufacturing technology for discrete and integrated optoelectronic device yield and cost. It is generally accepted that substrate defect structure, surface characteristics, and purity are significant factors which determine the quality of grown epitaxial layer structures used in the making of long-wavelength InP/InGaAsP optoelectronic devices. Therefore this program will direct significant effort toward the development of improved bulk crystal growth and substrate finishing technology which addresses these problems.

1030. ACCESS – Advanced Customer Connection: An Evolutionary System Strategy. ACCESS will investigate the Customer Access Connection (CAC) based on digital transmission on optical fibers. The project covers:

- Identification of requirements and establishment of specification
- Study of CAC structures and concepts to identify solutions optimum for cost-effective realization in early IBCN
- Examination of relevant technologies and development of components and modules for low-cost implementation
- Design, construction and assembly of demonstrators
- Technoeconomic assessment of the technological achievements and the demonstrators, leading to proposals for cost effective realization of CAC.

1031. Low-Cost Optoelectronic Components. The project objective is to develop manufacturing technologies and device designs with the production of large volumes of low-cost active optoelectronic components in line with the IBC network requirements covering five specific areas: market forecast, chip technology, low-cost packaging; hybrid optoelectronic modules, and component evolution and test.

1032. Development and Testing of Optical Components for Subscriber Networks. The program of work includes establishing enabling technology for low installed cost single-fiber connectors, single- and multifiber joining systems and all fiber wave-division multiplexed couplers and related components. It will carry out preliminary studies on multifiber connectors and connectors for coherent systems.

1033. OSCAR – Optical Switching Systems, Components and Applications Research. OSCAR is to develop the key optical switching technologies required for the evolution toward integrated optical networks. It will address the following:

- Control and integration of optical switches
- Integration of optical switches with optoelectronic components
- Stability and packaging of switch elements in the telecommunications environment
- Cost and performance tradeoffs.

1034. Usability Engineering Requirements for IBC. Project 1034 will require analysis of the communication activities of IBC and of human communication characteristics relevant to IBC. The project will produce a framework for investigating the usability engineering requirement, and will produce some initial results by targeting on some of the important issues.

1035. Customer Premises Network (CPN). It will be important to standardize interfaces and keep their number low. This will enable manufacturers to develop products toward a single global market and constraints originating from different countries and application will disappear.

1036. Wavelength and Time Division Multiplexed Broadband Customer Premises Network. This project is to develop a broadband customer premises network (BCPN) suitable for broadband service providers and for a wide range of other corporate applications. this will be essential to ensure the large-scale use of IBCN.

Included will be:

- Integrated circuits for high speed multiplexing and demultiplexing
- The optical star coupler
- Techniques and devices for optical wavelength demultiplexing
- High-speed optical receivers.

1037. User Criteria for the Realization of Opportunities Afforded by IBC. Project 1037 will identify user opportunities afforded by IBC and establish criteria under which such opportunities might be grasped in the short term and sustained in the long term. In terms of the OSI layer model, interest will focus on the interfaces between layer seven and additional layers above. An eighth layer should describe user applications – i.e., include terminals and various combinations of services which will be packaged for particular uses. Human factors will be a major component of investigation of this layer. A ninth layer would describe the microenvironment in which the use takes place – home or workplace. The tenth layer comprises the larger environment in which use occurs and considers effects of new applications on whole economic sectors or even societies.

1038. Multimedia Communications, Processing, and Representation. This project will develop a concept and an architecture for a multimedia communication, processing, and representation system for broadband applications. Highlights are:

- Demonstrator for an integrated text, graphic, facsimile, voice, and video application
- Multiservice monitor for fixed mode and videophone
- Processing of text, graphic, facsimile, voice and video information
- Adequate user interfaces
- Broadband, communication interface to CPN and IBCN.

1039. DIMUN. The use of advanced telecommunication services in public networks requires special features and equipment for manufacturing applications. In manufacturing, there are standards in development such as MAP and TOP but they are applicable only for the local area. In contrast to standard office applications there exist short but time-critical messages, non-time-critical transfer of long files, and pictures or video information.

Based on existing services and protocols such as X.25, X.400, TOP, and Office Document Architecture, new intelligent services will be developed and tested in a pilot system with use of existing manufacturing facilities in different countries. The goal of DIMUN is:

- Development of advanced telecommunication services for manufacturing applications, based on existing networks
- Link to industrial standard LAN
- Preparation for application of broadband facilities in monitoring, diagnosis, maintenance, repair, workplan display, and on-the-job training.

1041. FUNCODE. This project will concentrate on activities relevant to OSI levels six and four. The main deliverables will be directed toward state-of-the-art, coding VS service, codec location, interoperability, codec evaluation, card codec/cost performance. The main emphasis will be on coding versus service and interoperability. Both will take account of development in multiservice terminals, digital video recording, domestic-business CPN, and decoding algorithm developments for video, telephony, videoconference, TV, and HDTV with focus toward the Network Reference Configuration developments.

1042. Functional Service Integration in Support of Professional User Groups – MULTI-MED. The project defines, specifies, develops a prototype, and evaluates a multimedia applications environment over an experimental international primary note ISDN.

The pilot network to be implemented will be Primary Rate ISDN supporting multimedia by virtue of service clusters on user sites with both real-time communications and store and forward working.

1043. Mobile Communications Project. The work aims toward standards for the connection of mobile services to the IBCN. The IBCN will also need to provide as many public and business data services to the mobile subscriber as economically viable. The project covers two main classes of mobile service:

- Universal Mobile Telecommunications System which provides speech and low to medium data-rate services. This aims to give virtually complete geographical coverage.
- Microwave Broadband.

1044. Functional Reference Model (FRM). This project will establish the logical hierarchy of the functions in IBC to at least two levels of detail, and will define the logical interfaces among these top layer functions.

The main deliverable of the FRM will be a high-level functional reference model which may be used directly in the common functional applications for IBC. The Consensus Management Project will integrate these contributions into the common functional specifications, and also provide the necessary feedback required for subsequent refinements.

1044/1.2. Customer Service Functions. The objective of this project is to prepare a set of functional specifications,

rather than to locate the specifications within an overall reference model. the project is to assess the impact on IBCN functionality of particular configurations of services that customers may require to support desirable applications, including:

- A functional specification allowing high-level services and applications to be constructed from common service components
- Integrated or compatible call-handling protocols that will support changes in the mix of service components used during a call
- User friendly procedures for call up and reconfiguration
- Implications for call charging.

1044/2.1. Reference Configurations. The objective of this project is to act as a focus for the synthesis and analysis of reference configurations, compiled from information supplied by all projects in Cluster 2 of Part I of the RACE Program. The project will prepare and maintain a set of comprehensive and cohesive reference configurations, which form the primary deliverables from the cluster to the Consensus Management Project.

The objectives are:

- To identify the target IBCN and provide relevant system specifications
- To forward proposals for standards
- To identify intermediate IBCN reference configurations and provide relevant system specifications.

1044/2.2. Evolutionary Planning. The main objective of this project is to define guidelines for the choice by each country of the optimum evolution strategy towards the optimum target reference configuration, which effectively implements the optimum functional model.

1044/2.5. Integrated Optical Networks. This project is to define an evolutionary strategy leading to an integrated optical network. Work will include the development of optical heterodyne/hemodyne transmission systems for increased bandwidth. This will influence the IBCN architecture.

1045. Consensus Management Project. This important project has the objective of:

- Preparation of common functional specifications for international standardization bodies and of common practices for the development and implementation of IBC based on the results of Part I work
- Interpretation of user requirements with respect to reference configurations for the orientation of the technical and systems engineering work in RACE based on the inputs from each sector
- Ensuring that the RACE program remains timely, will directed and competitive within the context of advanced telecommunications research worldwide
- The effective communications with the RACE environment in all activities relating to RACE but not coming under the provision of the RACE council decision
- The organization and implementation of activities directed toward establishing board consensus with other sectors on common functional specifications proposals
- Information on RACE participants in technical developments related to specifications worldwide and the support of dissemination of common functional specifications related technical results to the European sector actors.

1046. SPECS (Specification and Programming Environment for Communications Software). SPECS' primary aim is the specification of a methodology to provide maximum automation and optimization of the whole software process from requirements and specifications through design, implementation, test, execution, and maintenance. Emphasis on formal methods and maximum automation will be applied throughout the project. All the addressed tasks are tightly intertwined, and the project will encourage, and profit from, the close coupling. The result of the project will be, over its duration, a set of methods, interfaces, functions, and techniques, defined in collaboration with other Part I projects, suited especially for the needs of IBCN software, available to the IBCN community members for smooth adaptation to specific industrial environments it will also provide feedback to the standards of CCITT and CEPT.

1048. RACE Strategy for Verification and a Plan. RACE has an objective of creating a common market for IBC technology and has sponsored a common development of precompetitive IBC technology. One key element will be common standards.

This project will perform initial studies and propose a common method for verification of compliance to these standards in Part II, propose a strategy for selecting IBC components to be verified, propose a work plan to accomplish Part III.1 and carry out liaison with Part I and other authority sources and achieve a consensus agreement on the verification approach to be adopted. The project will also provide various support to the proposed approach.

Reference

The RACE Programme in 1988, Commission of the European Communities, DG XIII - Telecommunications, Information Industries and Innovation, Brussels, 10 March 1988